

Wherefore, what is claimed is:

1. A computer-implemented process for generating a three dimensional model of an object from a single image, comprising the process actions of:

obtaining an image of an object;
identifying at least one object to be modeled in the image;
determining features of the object in the image; and
aligning the features of a generic model of the identified object with the features of the object in the image to obtain a tailored model.

2. The computer-implemented process of Claim 1 further comprising the process action of:

applying texture of the object in the image to the tailored generic model.

3. The computer-implemented process of Claim 1, further comprising the process actions of:

determining if the object in the image is rotated out of the plane of the image prior to using the features of the object in the image to align the features of a generic model of the object with the features of the object in the image to obtain a tailored model;
determining the amount of out of plane rotation of the object in the image;
and

using the amount of rotation of the object in the image to rotate the generic model to match the input image.

4. The computer-implemented process of Claim 1 wherein the
5 process action of determining the features of the object comprises determining the features by at least one of the following:

using a pattern recognition technique to locate the features;

an edge detection technique to locate the features; and

using a generic model of the object to locate the features.

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5. The computer-implemented process of Claim 1 wherein the generic model of the object is represented as a linear combination of a neutral object, and some number of object metrics, wherein an object metric is a vector that linearly deforms the object in a certain way.

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6. The computer-implemented process of Claim 4 wherein the linear combination of a neutral object is represented by a mesh of vertices and triangles that represent the shape of the object.

20 7. The computer-implemented process of Claim 4 wherein the process action of aligning the feature of a generic model of the object to the features of the object in the image to obtain a tailored model comprises

modifying the object metrics so that the generic model matches the shape of the object in the image.

5 8. The computer-implemented process of Claim 1 wherein the object modeled is a face.

 9. The computer-implemented process of Claim 1 wherein the object modeled is a human body.

10 10. The computer-implemented process of Claim 1 wherein the object modeled is an animal.

 11. The computer-implemented process of Claim 1 wherein multiple objects are modeled by repeating the following process actions for more than
15 one object:

 identifying at least one object to be modeled in the image;

 determining features of the object in the image; and

 aligning the features of a generic model of the identified object with the features of the object in the image to obtain a tailored model.

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 12. A system for creating a face model from the input of a single image of a face, the system comprising:

a general purpose computing device; and
a computer program comprising program modules executable by the
computing device, wherein the computing device is directed by the program
modules of the computer program to,

- 5 input a single image of a face;
 use a face detector to find the face to be modeled in the image;
 determine features of the face to be modeled;
 align features of a generic face model to features of the face in the
image to obtain a tailored face model; and
10 apply the texture of the face in the image to the tailored generic
face model.

13. The system of Claim 12 further comprising modules to:
 determine if the face in the image is rotated out of the plane of the image
15 prior to using the features of the face in the image to align the features of a
generic face model with the features of the face;
 determine the amount of out of plane rotation of the face in the image;
and
 use the amount of rotation of the face in the image to rotate the generic
20 face model to match the face in the input image.

14. The system of Claim 12 wherein the features of the face to be modeled comprise two eyebrows, two eyes, a nose, a mouth and two sides of a face.
- 5 15. The system of Claim 12 wherein the generic model of a face is represented as a linear combination of a neutral face, and some number of face metrics, wherein a face metric is a vector that can linearly deform the neutral face model in a certain way.
- 10 16. The system of Claim 15 wherein a generic model of a face is represented by a vector $S = (v_1^T, \dots, v_n^T)^T$ where $v_i = (X_i, Y_i, Z_i)^T$ ($i = 1, \dots, n$) are the vertices, and a metric is represented by a vector $M = (\delta v_1, \dots, \delta v_n)^T$, where $\delta v_i = (\delta X_i, \delta Y_i, \delta Z_i)^T$.and wherein a neutral face $S^0 = (v_1^{0T}, \dots, v_n^{0T})^T$, and a set of m metrics $M^j = (\delta v_1^{jT}, \dots, \delta v_n^{jT})^T$, and wherein the linear space of face geometries
- 15 spanned by these metrics is

$$S = S^0 + \sum_{j=1}^m c_j M^j \text{ subject to } c_j \in [l_j, u_j]$$

where the c_j 's are the metric coefficients, and l_j and u_j are the valid range of c_j .

17. The system of Claim 15 wherein the linear combination of a neutral
- 20 face is represented by a mesh of vertices and triangles that represent the shape of the face.

18. The system of Claim 15 wherein using the features of the object to be modeled to align the features of a generic face model to the feature points of the face in the image comprises modifying the face metrics so that the generic face model matches the shape of the face in the image.

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19. The system of Claim 15 wherein using the features of the face to be modeled to align the features of a generic face model to the features of the face in the image comprises modifying the face metrics so that the generic face model matches the shape of the face in the image.

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20. The system of Claim 19 wherein modifying the metrics comprises:
calculating the differences between the generic face model and the face in the image; and

adjusting the generic face model to represent the face in the image by
15 using said calculated differences to adjust the generic face model.

21. The system of Claim 17 wherein the module for applying texture comprises:

associating each vertex on the generic face model with its coordinates in
20 the image; and

using said associated coordinates of the vertices with the image to apply
said texture of the original image.

22. A computer-readable medium having computer-executable instructions for creating a three-dimensional model of an object in a single image, said computer executable instructions comprising:
- 5 inputting a single image of a three-dimensional object;
- creating a generic linear space representation of the three-dimensional object depicted in the image;
- estimating object pose and linear coefficients describing the three-dimensional object in the image in the linear space using an orthogonal
- 10 projection;
- using the estimated pose and linear coefficients to obtain a linear space model of the object in the image; and
- applying texture information of the three-dimensional object in the image to the linear space model of the object.
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23. The computer-readable medium of Claim 22 wherein said computer-executable instruction for creating a generic linear space representation of the three-dimensional object depicted in the image, comprises sub-instructions for:
- 20 using an object detector to find the object to be modeled in the image;
- determining features of the object; and

using the features of the object to be modeled to align the features of a generic linear space representation of the object to the shape of the object in the image.

- 5 24. The computer-readable medium of Claim 22 further comprising a computer-executable instruction for changing the characteristics of the linear space model of the object by changing the shape of the linear space model of the object in the image underlying the texture.